

What is claimed is:

1. A method of rebuilding an existing single hull tanker into a rebuilt double hull tanker comprising:
  - forming an outer bottom hull from existing outer bottom plating;
  - cutting temporary cut-outs in existing topside decking;
  - installing at least a portion of a new inner bottom hull through said temporary cut-outs in said existing topside decking;
  - forming said new inner bottom hull from new inner bottom plating installed internally over said existing outer bottom plating;
  - connecting said new inner bottom hull and said existing outer bottom hull in a spaced apart relationship using a plurality of connecting members to form a new double bottom hull;
  - forming inner side hulls from existing inner side plating;
  - forming new outer side hulls from new outer side plating installed externally over said existing inner side plating; and
  - connecting said existing inner side hulls and said new outer side hulls in a spaced apart relationship using a plurality of connecting members to form new port and starboard double side hulls;
  - wherein said new double bottom hull and said new double side hulls form a new double hull over at least a cargo carrying portion of said rebuilt double hull tanker.
2. The method according to claim 1, wherein said existing single hull tanker further comprises at least one center cargo tank, a port wing cargo tank, and a starboard wing cargo tank, said method further comprising the steps of:
  - cutting at least one temporary cut-out in said existing topside decking at a location between adjacent transverse bulkheads for each of said at least one center cargo tanks; and
  - installing at least a center portion of said new inner bottom hull through said at least one temporary cut-out internally over existing web framing of each of said at least one center cargo tanks between said adjacent transverse bulkheads.
3. The method according to claim 2, said method further comprising the steps of:
  - cutting at least one temporary cut-out in said existing topside decking at a location above each of said at least one center cargo tanks between adjacent longitudinal bulkheads;
  - and

installing at least a center portion of said new inner bottom hull through said at least one temporary cut-out internally over said existing web framing of each of said at least one center cargo tanks between said adjacent longitudinal bulkheads.

4. The method according to claim 2, said method further comprising the steps of:

cutting at least one temporary cut-out in said existing topside decking at a location above said port wing cargo tank between said existing side hull and an immediately inboard longitudinal bulkhead for each port wing cargo tank;

installing at least a port side portion of said new inner bottom hull through said at least one temporary cut-out and internally over existing web framing for each port cargo wing tank;

cutting at least one temporary cut-out in said existing topside decking at a location above said starboard wing cargo tank between said existing side hull and an immediately inboard longitudinal bulkhead for each starboard wing cargo tank; and

installing at least a starboard side portion of said new inner bottom hull through said at least one temporary cut-out and internally over existing web framing for each starboard cargo wing tank.

5. The method according to claim 2, said method further comprising the steps of:

cutting temporary access holes into said existing port side plating at a location above a turn of the bilge and existing web framing of said existing single hull;

installing at least a port side portion of said new inner bottom hull through said temporary access holes in said existing port side plating and internally over said existing web framing for each port cargo wing tank;

cutting temporary access holes into said existing starboard side plating at a location above a turn of the bilge and existing web framing of said existing single hull; and

installing at least a starboard side portion of said new inner bottom hull through said temporary access holes in said existing starboard side plating and internally over said existing web framing for each starboard cargo wing tank.

6. The method according to claim 1, said method further comprising the step of locating said temporary cut-outs in said existing topside decking at a location that minimizes the disruption of existing machinery and piping.

7. The method according to claim 1, wherein said temporary cut-outs further comprise a length and a width, said method further comprising the step of orienting said length of said temporary cut-out athwartships.
8. The method according to claim 1, wherein said temporary cut-outs further comprise a length and a width, said method further comprising the step of orienting said length of said temporary cut-out fore and aft.
9. The method according to claim 1, said method further comprising the step of closing said temporary cut-outs in said existing topside decking using inserts.
10. The method according to claim 1, said method further comprising the steps of:  
renewing existing topside decking that was removed to form said temporary cut-out to form inserts; and  
closing said temporary cut-outs in said existing topside decking using said inserts after installation of said new inner bottom hull.
11. The method according to claim 5, said method further comprising the steps of:  
renewing existing side plating that was removed to form said temporary access holes to form inserts; and  
closing said temporary access holes in said existing side plating using said inserts after installation of said new inner bottom hull.
12. The method according to claim 1, said method further comprising the steps of:  
cutting existing port and starboard turn of the bilges and temporarily removing said port and starboard turn of the bilges;  
connecting new port and starboard bottom filler pieces to each outboard end of said new double bottom hull where said existing port and starboard turn of the bilges were cut-away and scribing said new bottom filler pieces to match said new double bottom hull;  
connecting said cut-away portions of said port and starboard turn of the bilges to an outboard end of each of said new port and starboard bottom filler pieces, respectively;

connecting new port and starboard outer side filler pieces over an exterior of said existing port and starboard inner side hulls and connecting said new port and starboard outer side filler pieces to said existing port and starboard turn of the bilges; and

scribing new outer portions of topside deck plating of said new port and starboard outer side filler pieces to match a contour of the shear strake of existing topside deck plating.

13. The method according to claim 1, said method further comprising the steps of:

connecting said existing outer bottom hull plating and said new inner hull plating in a spaced-apart relationship using existing transverse web framing to form a central portion of said rebuilt double bottom hull;

forming new longitudinal stiffener members on a topside of said new inner hull plating;

fitting and connecting new port and starboard bottom filler pieces to port and starboard outboard ends of said central portion of said rebuilt double bottom hull, said bottom filler pieces having a width substantially equal to a width of said new double side hulls;

connecting existing port and starboard turn of the bilges to port and starboard outboard ends, respectively, of said new bottom filler pieces;

fitting and connecting new port and starboard side filler pieces to said port and starboard existing turn of the bilges, respectively, and connecting said new side filler pieces to said existing inner side hull plating using new connecting plates; and

fitting and connecting new port and starboard outer portions of topside deck plating over said new port and starboard side filler pieces and connecting said new port and starboard outer portions of topside deck plating to an outer port and starboard peripheral edge of existing topside deck plating.

14. The method according to claim 1, said method further comprising the steps of:

forming one or more of slots in said new inner bottom plating at a location corresponding to a location of existing support brackets between existing longitudinal bulkheads and existing transverse framing members;

laying said new inner bottom plating on said existing transverse framing members and fitting said one or more slots in said new inner bottom plating around said existing support brackets; and

filling a space between said one or more slots in said new inner bottom plating and said existing support brackets.

15. The method according to claim 1, said method further comprising the steps of:  
forming faired sections in a transition region between said new outer side hulls and said existing side hulls proximate a bow region and a stern region; and  
designing said faired sections to provide a relatively smooth transition region between said new outer side hulls and said existing side hulls proximate a bow region and a stern region for a smoothing hydrodynamic transition fore and aft in the area where said new double side hull and said existing single side hull meet.
16. The method according to claim 15, wherein said designing step further comprises one or more of the following steps:  
performing model basin testing of a model replica of said tanker to be rebuilt; and  
performing computational fluid dynamics of said tanker to be rebuilt.
17. The method according to claim 16, wherein said step of performing model basin testing further comprises the steps of testing and comparing one or more of:  
flow fields in the bow region;  
flow fields in the stern region;  
surface pressure contours at the bow region below the waterline;  
surface pressure contours at the stern region below the waterline;  
bow wave contours; and  
bare-hull resistance.
18. The method according to claim 16, wherein said step of performing model basin testing further comprises the steps of:  
constructing a model representative of said existing single hull tanker;  
testing said model representative of said existing single hull tanker;  
constructing a model representative of said rebuilt double hull tanker;  
testing said model representative of said rebuilt double hull tanker;  
using a molding material to simulate one or more design for said faired sections by  
applying successive layers of said molding material to an exterior of said model replica of

said rebuilt double hull tanker to be rebuilt in a bow transition region and a stern transition region;

comparing results of said testing of said model representative of said existing single hull tanker with results of said testing of said model representative of said rebuilt double hull tanker having said successive layers of said molding material; and

designing said faired sections based on said comparison of said model basin testing.

19. The method according to claim 16, wherein said step of performing computational fluid dynamics further comprises the steps of computing of and comparing one or more of:

flow fields in the bow region;

flow fields in the stern region;

surface pressure contours at the bow region below the waterline;

surface pressure contours at the stern region below the waterline;

bow wave contours; and

bare-hull resistance.

20. The method according to claim 16, wherein said step of performing computational fluid dynamics further comprises the steps of:

providing a computing system having software for performing basic equations of fluid motion by massive iterative computations;

inputting data representative of said existing single hull tanker;

generating results for said existing single hull tanker;

inputting data representative of one or more designs for said faired sections of said tanker to be rebuilt;

generating results for said tanker to be rebuilt;

comparing results of said computations of said existing single hull tanker with results of said computations of said rebuilt double hull tanker having one or more designs for said faired sections; and

designing said faired sections based on said comparison of said computational fluid dynamics.

21. The method according to claim 16, further comprising the steps of:  
comparing results of said step of performing model basin testing with results of said step of performing computational fluid dynamics; and  
designing said faired sections based on said comparison of said model basin testing and said computational fluid dynamics.
22. A method of rebuilding an existing single hull tanker into a rebuilt double hull tanker comprising the steps of:  
forming an outer bottom hull from existing outer bottom plating;  
forming said new inner bottom hull from new inner bottom plating installed internally over said existing outer bottom plating;  
connecting said new inner bottom hull and said existing outer bottom hull in a spaced apart relationship using a plurality of connecting members to form a new double bottom hull;  
forming inner side hulls from existing inner side plating;  
forming new outer side hulls from new outer side plating installed externally over said existing inner side plating; and  
connecting said existing inner side hulls and said new outer side hulls in a spaced apart relationship using a plurality of connecting members to form new port and starboard double side hulls;  
wherein said new double bottom hull and said new double side hulls form a new double hull over at least a cargo carrying portion of said rebuilt double hull tanker;  
forming faired sections in a transition region between said new outer side hulls and said existing side hulls; and  
designing said faired sections to provide a relatively smooth transition region between said new outer side hulls and said existing side hulls proximate a bow region and a stern region for a smoothing hydrodynamic transition fore and aft in the area where said new double side hull and said existing single side hull meet.
23. The method according to claim 22, wherein said designing step further comprises one or more of the following steps:  
performing model basin testing of a model replica of said tanker to be rebuilt; and  
performing computational fluid dynamics of said tanker to be rebuilt.

24. The method according to claim 23, wherein said step of performing model basin testing further comprises the steps of testing and comparing one or more of:

- flow fields in the bow region;
- flow fields in the stern region;
- surface pressure contours at the bow region below the waterline;
- surface pressure contours at the stern region below the waterline;
- bow wave contours; and
- bare-hull resistance.

25. The method according to claim 23, wherein said step of performing model basin testing further comprises the steps of:

- constructing a model representative of said existing single hull tanker;
- testing said model representative of said existing single hull tanker;
- constructing a model representative of said rebuilt double hull tanker;
- testing said model representative of said rebuilt double hull tanker;
- using a molding material to simulate one or more design for said faired sections by applying successive layers of said molding material to an exterior of said model replica of said rebuilt double hull tanker to be rebuilt in a bow transition region and a stern transition region;
- comparing results of said testing of said model representative of said existing single hull tanker with results of said testing of said model representative of said rebuilt double hull tanker having said successive layers of said molding material; and
- designing said faired sections based on said comparison of said model basin testing.

26. The method according to claim 23, wherein said step of performing computational fluid dynamics further comprises the steps of computing of and comparing one or more of:

- flow fields in the bow region;
- flow fields in the stern region;
- surface pressure contours at the bow region below the waterline;
- surface pressure contours at the stern region below the waterline;
- bow wave contours; and
- bare-hull resistance.



27. The method according to claim 23, wherein said step of performing computational fluid dynamics further comprises the steps of:

providing a computing system having software for performing basic equations of fluid motion by massive iterative computations;

inputting data representative of said existing single hull tanker;

generating results for said existing single hull tanker;

inputting data representative of one or more designs for said faired sections of said tanker to be rebuilt;

generating results for said tanker to be rebuilt;

comparing results of said computations of said existing single hull tanker with results of said computations of said rebuilt double hull tanker having one or more designs for said faired sections; and

designing said faired sections based on said comparison of said computational fluid dynamics.

28. The method according to claim 23, further comprising the steps of:

comparing results of said step of performing model basin testing with results of said step of performing computation fluid dynamics; and

designing said faired sections based on said comparison of said model basin testing and said computational fluid dynamics.